

**REVISION OF NORTH AMERICAN *ALEIODES* WESMAEL (PART 3): THE
SERIATUS (HERRICH-SCHAEFFER) SPECIES-GROUP (HYMENOPTERA:
BRACONIDAE: ROGADINAE)**

PAUL M. MARSH AND SCOTT R. SHAW

(PMM) Cooperating Scientist, USDA Systematic Entomology Laboratory, PSI, Agricultural Research Service, U.S. Department of Agriculture, Bldg. 046, BARC-W, Beltsville, MD 20705, U.S.A. (correspondence address: P. O. Box 384, North Newton, KS 67117 U.S.A.) (e-mail swampy@southwind.net); (SRS) Department of Plant, Soil and Insect Sciences, P.O. Box 3354, University of Wyoming, Laramie, WY 82071 U.S.A., (e-mail braconid@uwyo.edu).

Abstract.—The *Aleiodes seriatus* (Herrich-Schaeffer) species-group is defined to include the following previously described species: *A. seriatus* (Herrich-Schaeffer), *A. femoratus* Cresson, *A. bakeri* (Brues), *A. nigristemmaticum* (Enderlein) **n. comb.**, *A. nigribasis* (Enderlein) **n. comb.**, *A. scriptus* (Enderlein) **n. comb.**, *A. nigricosta* (Enderlein) **n. comb.**, *A. percurrens* (Lyle) **n. comb.** and *A. sanctivincentensis* (Shenefelt) **n. comb.** (replacement name for *Rhogas pectoralis* Ashmead). Five new species are also described: *A. akidnus* **n. sp.**, *A. pardalotus* **n. sp.**, *A. preclarus* **n. sp.**, *A. virginiensis* **n. sp.**, and *A. wahl* **n. sp.** The *Aleiodes seriatus* species-group is considered monophyletic and distinguished by a row of flattened, coalesced setae at the apex of the hind tibia on the inner side. An identification key, descriptions, distribution and biological information for the seven North American species are provided.

Key Words: Braconidae, *Aleiodes*, taxonomy, revision

The rogadine braconid genus *Aleiodes* Wesmael is worldwide in distribution, but is particularly species-rich in the Holarctic Region. *Aleiodes* is well diversified in North America, with at least 90 species in the United States and Canada (S. Shaw et al. 1997). This study is the third in a series of planned papers on *Aleiodes* species-groups, intended to provide a complete revision of the genus for North America (see S. Shaw et al. 1997, 1998). The *A. seriatus* (Herrich-Schaeffer) group is moderate sized with species occurring in the Palaearctic, Nearctic, Neotropical and Indo-Australian regions. This is a distinctive monophyletic group with all species having a row of flattened, coalesced setae (Figs. 10, 11) at the

apex of the hind tibia on the inner side (see discussion below under Comments after the species-group diagnosis). Our definition of this species-group includes all species known to us worldwide. However, because our main intent is to provide a revision of the North American species, species treatments are limited to the Nearctic fauna.

Aleiodes species are koinobiont endoparasitoids of lepidopterous larvae, especially macrolepidoptera of the superfamilies Noctuoidea and Geometroidea, and to a lesser extent, Arctioidea, Sphingoidea, and Papilionoidea (S. Shaw et al. 1997). Very little is known about the biology of the *seriatus* species-group, but the few records indicate parasitism of hadenine and catocaline noc-

tuids and arctiids. The method of parasitism, unique to the tribe Rogadini, is noteworthy: the *Aleiodes* larva completes its feeding and pupates within the shrunk and mummified remains of the host caterpillar. In all known cases, the form of the mummy caused by a particular *Aleiodes* species is characteristic for that host and parasitoid, so mummified remains are of considerable diagnostic value and should be retained with the parasitoid when reared. For a more complete discussion of *Aleiodes* biology, readers may refer to M. Shaw (1983, 1994), M. Shaw and Huddleston (1991), S. Shaw (1995, 1997), and S. Shaw et al. (1997).

METHODS

Species covered in this paper can be identified as members of the subfamily Rogadinae using the keys of S. Shaw (1995), M. Shaw and Huddleston (1991) or Wharton et al. (1997). Our definition of *Aleiodes* follows that of S. Shaw (1993), S. Shaw et al. (1997) and van Achterberg (1991). Specimens can be determined as *Aleiodes* using the keys of Shaw (1997). The species-groups of North American *Aleiodes* can be keyed using the key provided in S. Shaw et al. (1997).

Terminology follows that used for *Aleiodes* by S. Shaw (1997), S. Shaw (1993) and Marsh (1989). Microsculpture terminology follows that of Harris (1979). General terminology and in particular wing vein terminology agrees with the system adopted for the Manual of New World Genera of the Family Braconidae (Wharton et al. 1997) and agrees closely to that of Goulet and Huber (1993). A labeled diagram of wing veins was provided by S. Shaw et al. (1997).

Acronyms for collections where type material is deposited are as follows: AEI (American Entomological Institute, Gainesville, FL), ABS (Archbold Biological Station, Lake Placid, FL), ANSP (Academy of Natural Sciences, Philadelphia), FSCA (Florida State Collection of

Arthropods, Gainesville, FL), NCDA (North Carolina Department of Agriculture, Raleigh, NC), PASW (Polish Academy of Sciences, Warsaw), RMSEL (Rocky Mountain Systematic Entomology Laboratory, University of Wyoming, Laramie, WY), USNM (National Museum of Natural History, Smithsonian Institution, Washington, DC), WVU (West Virginia University, Morgantown, WV).

ALEIODES SERIATUS SPECIES-GROUP

Included species.—*seriatus* (Herrich-Schaeffer) 1838, Europe; *femoratus* Cresson 1896, U.S.; *bakeri* (Brues) 1912, Brazil; *nigristemmaticum* (Enderlein) 1920, **n. comb.**, U.S., Mexico, Central and northern South America; *nigribasis* (Enderlein) 1920, **n. comb.**, Ecuador; *scriptus* (Enderlein) 1920, **n. comb.**, Brazil; *nigricosta* (Enderlein) 1920, **n. comb.**, Brazil; *percurrens* (Lyle) 1921, **n. comb.**, India; *sancti-vincentensis* (Shenefelt) 1975, **n. comb.** (replacement name for *pectoralis* Ashmead 1894), St. Vincent; *akidmus*, **n. sp.**; *pardalotus*, **n. sp.**; *preclarus*, **n. sp.**; *virginieusis*, **n. sp.**; and *wahli*, **n. sp.**

Diagnostic characters.—Eyes and ocelli usually large, the ocellocular distance equal to diameter of lateral ocellus, sometimes much less (Figs. 1, 2, 5), one species with smaller ocelli with the ocellocular distance twice the ocellar diameter (Figs. 3, 4); hind wing vein RS usually straight (Fig. 8) or bent downward after the middle (Figs. 6, 7), occasionally slightly sinuate (Fig. 9); hind tibia with dense cluster of flattened setae at apex on inner side (Figs. 10, 11).

Comments.—This is a moderately sized mostly New World species-group associated with noctuids and arctiids. We have seen numerous undetermined specimens from Costa Rica indicating that this species-group is probably well represented in the Neotropical Region. The cluster of flattened setae at the apex of the hind tibia will distinguish the species from all other groups.

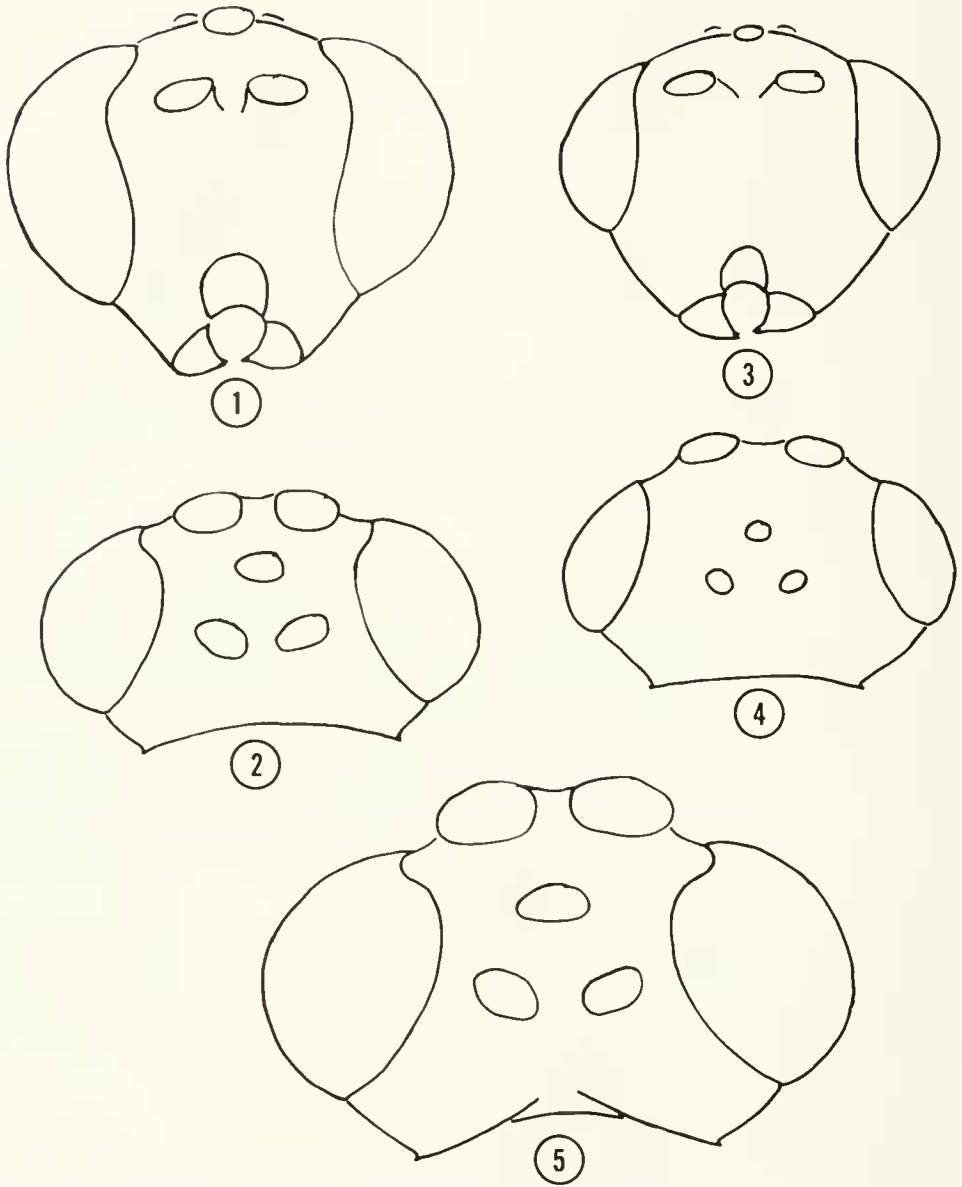
Recent research by Fortier (1997) indicates that the *seriatus*-group is monophyletic, as defined by the specialized row of flattened setae on the hind tibia. However, some confusion could result because this feature is convergently evolved in some other rogadine genera including *Rogas* Nees, *Cystomastax* Szepilgeti, and *Macrostomion* Szepilgeti (see Figs. 16, 17 of Shaw 1997), as well as in the homolobine genus *Exasticolus* (see Fig. 7 of Wharton 1997). Careful attention needs to be given to the details of tarsal claw form, propodeal and mesopleural sculptural, and forewing venation to avoid confusing members of the *Aleiodes seriatus*-group with other rogadines having a similar fringe of flat setae (Shaw 1997). Most notably, all species of *Rogas*, *Cystomastax*, and *Macrostomion* have the tarsal claw with a large, blunt basal lobe or tooth, while this feature is absent in the *Aleiodes seriatus*-group. It was suggested by van Achterberg (1979) that in *Exasticolus* this flattened "comb" of setae may "facilitate walking on the webs of the hosts" which are Lasiocampidae. However, it seems unlikely that this structure was evolved for that function for two reasons: first, the feature occurs in several genera that parasitize a variety of different lepidopteran hosts (including Limacodidae, Lycaenidae, Riodinidae, Arctiidae, and Noctuidae), most of which do not form extensive silk-shelters as in lasiocampids; and secondly, the feature is not sexually dimorphic, therefore occurs in males that are not involved in host-searching. Although it is true that all the species having this characteristic seem to be nocturnally-active parasitoids of exposed-feeding lepidopteran larvae, the comb of seta may have no host-related function at all. Perhaps it is an adaptation for cleaning the body, or perhaps it is merely the result of genetic drift and has no particular function. Clearly, behavioral observations of species in these genera are needed to resolve this issue.

KEY TO THE NORTH AMERICAN SPECIES OF THE *SERIATUS*-GROUP

- 1. Ocelli small, ocellocular distance 2 times or more diameter of lateral ocellus (Fig. 4); fore wing vein r equal to or longer than 3RSa (Fig. 9) *akidnus*, new species
 - Ocelli large, ocellocular distance at most equal to diameter of lateral ocellus, usually much less (as in Figs. 2, 5); fore wing vein r shorter than 3RSa (as in Figs. 6-8) 2
- 2(1). Metasoma yellow with black spots on basal 1/2 of first tergum and laterally on second and third terga *pardalotus*, new species
 - Metasoma uniformly brown, orange or honey yellow 3
- 3(2). Hind wing vein RS straight, marginal cell gradually widening to wing apex (Fig. 8); fore wing stigma brown, at most yellow at extreme apex *femoratus* Cresson
 - Hind wing vein RS parallel to wing margin on basal 1/3, suddenly curved downward, marginal cell suddenly widened at apex (Figs. 6, 7); fore wing stigma yellow or bicolored brown with yellow at base and apex 4
- 4(3). Fore wing stigma entirely yellow; occipital carina complete across vertex (Fig. 2) *nigristemmaticum* (Enderlein)
 - Fore wing stigma bicolored brown with yellow at apex and base; occipital carina interrupted on vertex (Fig. 5) 5
- 5(4). Mesosoma and legs entirely honey yellow, tegula yellow *virgucensis*, new species
 - Mesosoma yellow with black or dark brown markings, hind femur brown on apical 1/4, hind coxa brown apicoventrally, tegula brown 6
- 6(5). Antennal flagellum yellow
 - *wahli*, new species
 - Antennal flagellum black
 - *preclarus*, new species

Aleiodes akidnus Marsh and Shaw,
new species
(Figs. 3, 4, 9)

Female.—*Color*: honey yellow, legs somewhat lighter, ocellar triangle black, flagellum brown except basal flagellomeres yellow, wings hyaline, veins brown. *Size*: body length, 4.0 mm; fore wing length, 3.0 mm. *Head*: eyes and ocelli small; 43–45 antennomeres, all flagellomeres longer than wide; malar space long, length twice basal



Figs. 1-5. Heads of *Alerodes* spp. 1, *A. nigristemmaticum*, anterior view. 2, *A. nigristemmaticum*, dorsal view. 3, *A. akidnus*, anterior view. 4, *A. akidnus*, dorsal view. 5, *A. virginiensis*, dorsal view.

width of mandible and $\frac{2}{3}$ eye height (Fig. 3); temple wide, about $\frac{1}{2}$ eye width; occipital carina complete, reaching hypostomal carina; hypoclypeal depression small and circular, diameter about equal to basal width of mandible and $\frac{1}{3}$ face height; mandibles small, tips not touching when closed; clypeus swollen; ocelli small, ocellocular

distance slightly more than twice diameter of lateral ocellus (Fig. 4); face, frons, temple and vertex entirely coriaceous, face with raised longitudinal ridge below antennae; maxillary palpus not swollen. *Mesosoma*: pronotum rugulose coriaceous, median length about equal to length of first flagellomere; mesonotum coriaceous; notauli

very weak and indistinct, indicated only by weak rugulose lines, small rugulose area before scutellum where notauli would meet; scutellum coriaceous, bordered laterally by carina; mesopleuron coriaceous, weakly rugose on subalar area and medially, sternaulus absent; propodeum rugulose coriaceous dorsally, coriaceous laterally, median carina complete. *Wings*: (Fig. 9): fore wing with vein r equal to or slightly longer than vein 3RSa, second submarginal cell nearly square, vein RS+Mb slightly longer than vein r, vein 1cu-a beyond vein 1M by distance slightly more than length of vein 1cu-a; hind wing vein RS weakly sinuate, marginal cell narrowest in middle, vein r-m shorter than vein 1M, veins M+CU and 1M about equal in length, vein m-cu absent. *Legs*: tarsal claws not pectinate; hind tibia with row of dense coalesced flattened setae at apex on inner side. *Metasoma*: first tergum costate coriaceous, longer than apical width, median carina complete; second tergum costate coriaceous, median carina complete; third tergum costate coriaceous on basal $\frac{3}{4}$, coriaceous on apical $\frac{1}{4}$, median carina complete; remainder of terga finely coriaceous; ovipositor short, about $\frac{1}{2}$ length hind basitarsus.

Male.—Unknown.

Holotype.—♀: FLORIDA, Monroe Co., Big Pine Key, Alligator Pond, July 2, 1978, L. Stange, black light trap. Deposited in FSCA.

Paratypes.—FLORIDA: 2 ♀, Leon Co., Tall Timbers Res. Sta., August 4–19, 1971, D. L. Harris; 1 female, Gainesville, October 31, 1965, Ladonia O'Berry. Deposited in USNM, RMSEL, FSCA.

Distribution.—Florida.

Biology.—Unknown.

Comments.—This species departs markedly from the other species in this group by its smaller eyes and ocelli and its wing venation. However, it is similar in habitus to other species with the flattened setae at the apex of the hind tibia, such as *sanctivincentsis* and a few undescribed species from Central America.

Etymology.—The specific name is from the Greek *akidmus* meaning "weak or feeble," in reference to the weak, indistinct notauli.

Aleiodes femoratus Cresson

(Fig. 8)

Aleiodes femoratus Cresson 1869: 382.

Diagnosis.—Body unicolored honey yellow, propleuron and mesopleuron dorsally and hind femur often marked with brown, wings lightly dusky, veins brown except C+Sc+R and 1R1 of fore wing which are yellow; body length 6.0–7.0 mm; 47–52 antennomeres; length of malar space equal to basal width of mandible; hypoclypeal depression small and circular, diameter less than basal width of mandible; face costulate-rugose, frons rugulose, vertex and temple coriaceous; propleuron rugose; mesonotum and scutellum coriaceous; sternaulus rugose; propodeum rugulose coriaceous, median carina present only basally; first, second and basal $\frac{2}{3}$ of third metasomal terga costate, median carina complete on first and second terga and base of third; fore wing (Fig. 8) with vein 1cu-a beyond 1M by distance greater than length of 1cu-a, vein r nearly as long as 3RSa, second submarginal cell short; hind wing with marginal cell gradually widening, vein RS straight, vein r-m longer than 1M; hind tibia with dense cluster of coalesced flattened setae on inner side at apex, tarsal claws not pectinate.

Type material examined.—*Aleiodes femoratus* Cresson, holotype ♀, West Virginia [ANSP].

Distribution.—We have examined specimens from West Virginia, Virginia, Maryland, North Carolina, Florida and Illinois. Probably occurs throughout the eastern U.S.

Biology.—Unknown.

Comments.—This species can be distinguished from others in the *seriatus* group by the unicolored stigma in the fore wing,

the gradually widening marginal cell and the straight vein RS in the hind wing.

Aleiodes nigristemmaticum (Enderlein),
new combination
 (Figs. 1, 2, 6, 10–12)

Rhogas nigristemmaticum Enderlein
 (1918)1920: 156.

Diagnosis.—Body unicolored yellow, scape and pedicel marked with light brown, flagellum brown on basal half to light brown at apex, ocellar triangle black, apical tarsomeres brown at apex, wings hyaline, veins light brown except C+Sc+R, stigma and 1R1 yellow; body length, 6.5–7.5 mm; 50–57 antennomeres; head coriaceous, eyes and ocelli large, covering most of head; malar space about equal to basal width of mandible and about $\frac{1}{4}$ eye height (Fig. 1), temple very narrow; hypoclypeal depression small and circular, diameter equal to malar space; ocellular distance less than diameter of lateral ocellus (Fig. 2); occipital carina complete; mesonotum and scutellum coriaceous, notauli weakly indicated; mesopleuron coriaceous, sternaulus rugulose; propodeum rugulose-coriaceous, median carina complete; first, second and base of third metasomal terga costate, median carina complete to base of third tergum; fore wing (Fig. 6) with vein 1cu-a beyond 1M by distance greater than length of 1cu-a, vein r nearly as long as 3RSa; hind wing with vein RS parallel to wing margin on basal $\frac{1}{3}$, suddenly curved downward so marginal cell is suddenly widened to apex, vein r-m longer than 1M; hind tibia with dense cluster of coalesced flattened setae on inner side at apex (Figs. 10, 11), tarsal claws not pectinate.

Type material examined.—*Rhogas nigristemmaticum* Enderlein, lectotype ♀ (here designated), Chiapas, Mexico [PASW]; paralectotype ♀, same data.

Distribution.—Florida, Mississippi, Mexico, Central America, northern South America, West Indies.

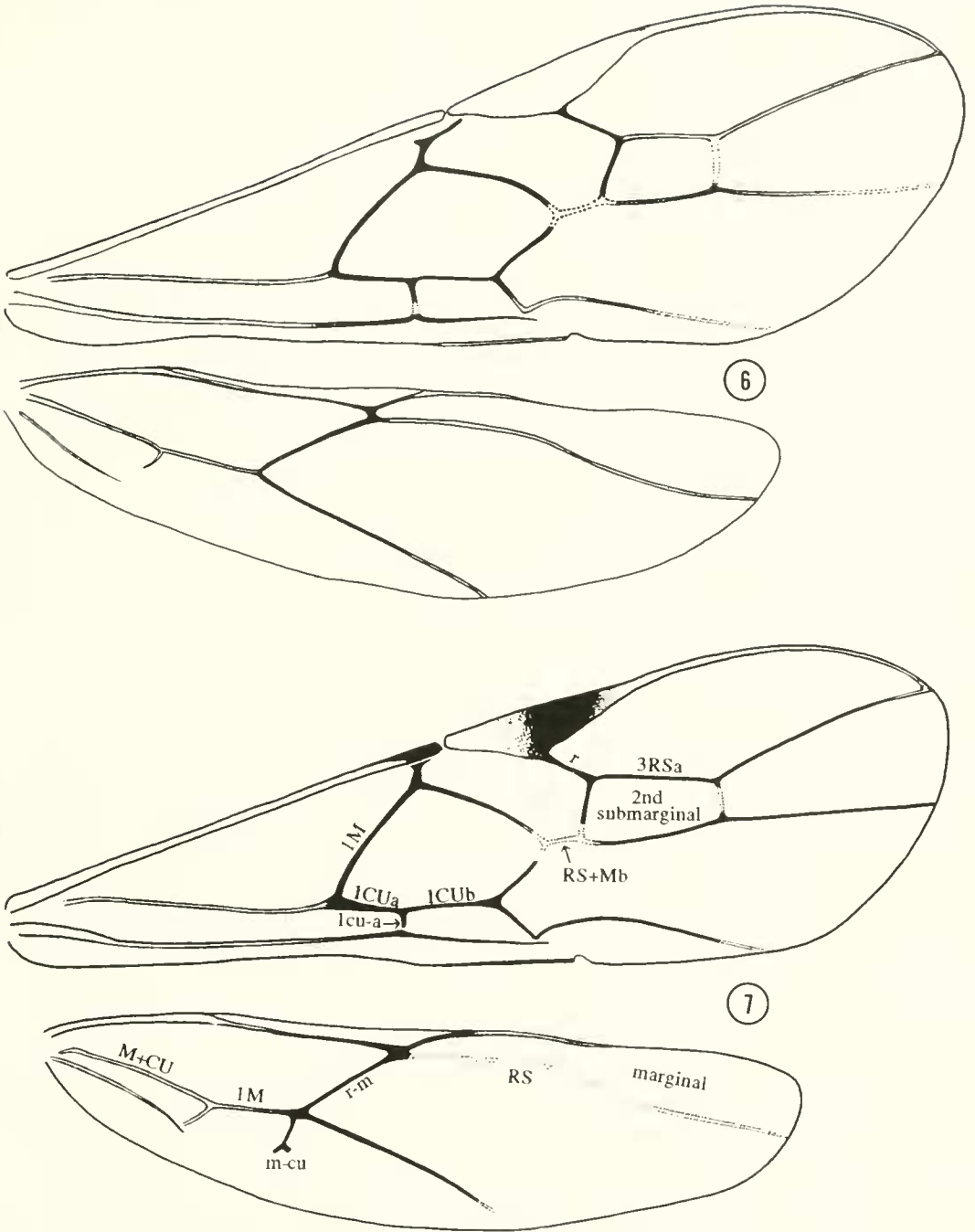
Biology.—Observations on the biology

of *A. nigristemmaticum* were made at the La Selva Research Station, Heredia Province, Costa Rica, during August 1994 by Mr. Les Price. The study site was an early successional secondary regrowth forest area, known locally as “La Flaminiá,” with dominant plants being *Mimosa*, grasses and *Phyllanthus* vines that were the food plant of the *Mocis* sp. larvae (Noctuidae) parasitized by *Aleiodes*. The parasitized host larva situated itself vertically on the host plant, with the head facing downward. The parasitoid larva formed a “glue-hole” at the prothoracic venter of the parasitized host larva, attaching the host to the substrate. As mummification progressed, the host larva projected its posterior end outward and upward at a 45° angle, and the larval cuticle is sloughed off anteriorly to form a dark brown to blackish mummy. The resulting mummy is very cryptic and resembles a plant bud or sepal (Fig. 12) due to its shape and color, and also its position on the plant. This may serve to protect the developing parasitoid from visually searching predators, such as birds, frogs and lizards, but it apparently is still quite exposed to hyperparasitism. Of the 28 host mummies collected, only three adults of *A. nigristemmaticum* emerged while seven hyperparasitoids of the genus *Couura* Spinola (Chalcididae) emerged during the same period. We have seen specimens from Venezuela and Honduras reared from *Mocis latipes* (Gn.).

Comments.—This species is distinguished by its yellow stigma, complete occipital carina and suddenly widened marginal cell of the hind wing.

Aleiodes pardalotus Marsh and Shaw,
new species

Female.—*Color*: ground color of body yellow; head with brown spot on face, brown spots on occiput behind eye, ocellar triangle black, scape brown on outer edge, pedicel brown, flagellum gradually turning light brown to apex; pronotum with black spot laterally behind head; median meso-



Figs. 6, 7. Wings of *Aleiodes* spp. 6, *A. nigristemmaticum*. 7, *A. virginiensis*.

notal lobe black on apical 1/2, lateral lobes black medially; scutellum black; mesopleuron with black spots on subalar area and venter; propodeum black basally; first meta-

somal tergum black on basal 1/2, second tergum with black spot laterally, third tergum with black spot laterally and medially at apex, fourth tergum black medially; apex of

hind coxa with black spot laterally, hind femur black at apex, hind tibia brown at base, middle and hind apical tarsomeres black; wings hyaline, veins brown except stigma yellow at apex and base, fore wing vein C+SC+R yellow medially. *Size*: body length, 5.5 mm; wing length, 4.5 mm. *Head*: eyes and ocelli large, covering most of head; 50 antennomeres, all flagellomeres short, only slightly longer than wide; malar space short, equal to basal width of mandible and $\frac{1}{5}$ eye height; temple narrow, $\frac{1}{5}$ eye width; occipital carina reaching hypostomal carina, slightly interrupted on vertex behind ocelli; hypoclypeal depression small and circular, width equal to basal width of mandible and less than $\frac{1}{2}$ face height; maxillary palpus not swollen; mandibles small, tips not touching when closed; clypeus not swollen; ocelli large, ocellular distance about $\frac{1}{3}$ diameter of lateral ocellus; face and frons weakly rugulose coriaceous, vertex and temple coriaceous. *Mesosoma*: pronotum strongly porcate; mesonotum and scutellum strongly coriaceous; notauli distinct but weakly impressed, meeting in large rugose area before scutellum; mesopleuron coriaceous with median and subalar area rugose, sternaulus absent; propodeum rugose coriaceous dorsally, coriaceous laterally, median carina complete. *Wings*: fore wing with vein r $\frac{1}{2}$ length 3RSa, vein 1cu-a beyond 1M by distance slightly more than twice length of 1cu-a, vein 1CUa only slightly shorter than 1CUB; hind wing vein RS slightly sinuate, marginal cell narrowest in middle, vein r-m longer than 1M, vein M+CU slightly more than twice length of 1M, vein m-cu weak, represented by very short fuscous line. *Legs*: tarsal claws not pectinate; hind tibia with row of dense coalesced flattened setae at apex on inner side. *Metasoma*: first tergum longer than apical width, costate coriaceous, median carina complete; second tergum costate coriaceous, median carina complete; third tergum costate coriaceous on basal $\frac{3}{4}$, coriaceous on apical $\frac{1}{4}$, median carina complete on basal $\frac{3}{4}$; remainder of terga coriaceous;

ovipositor about $\frac{1}{3}$ length of hind basitarsus.

Male.—Unknown.

Holotype.—♀: FLORIDA, Archbold Biol. Sta., Lk. Placid, Highlands Co., January 25, 1985, M. Deyrup. Deposited in USNM.

Distribution.—Known only from the type locality in Florida.

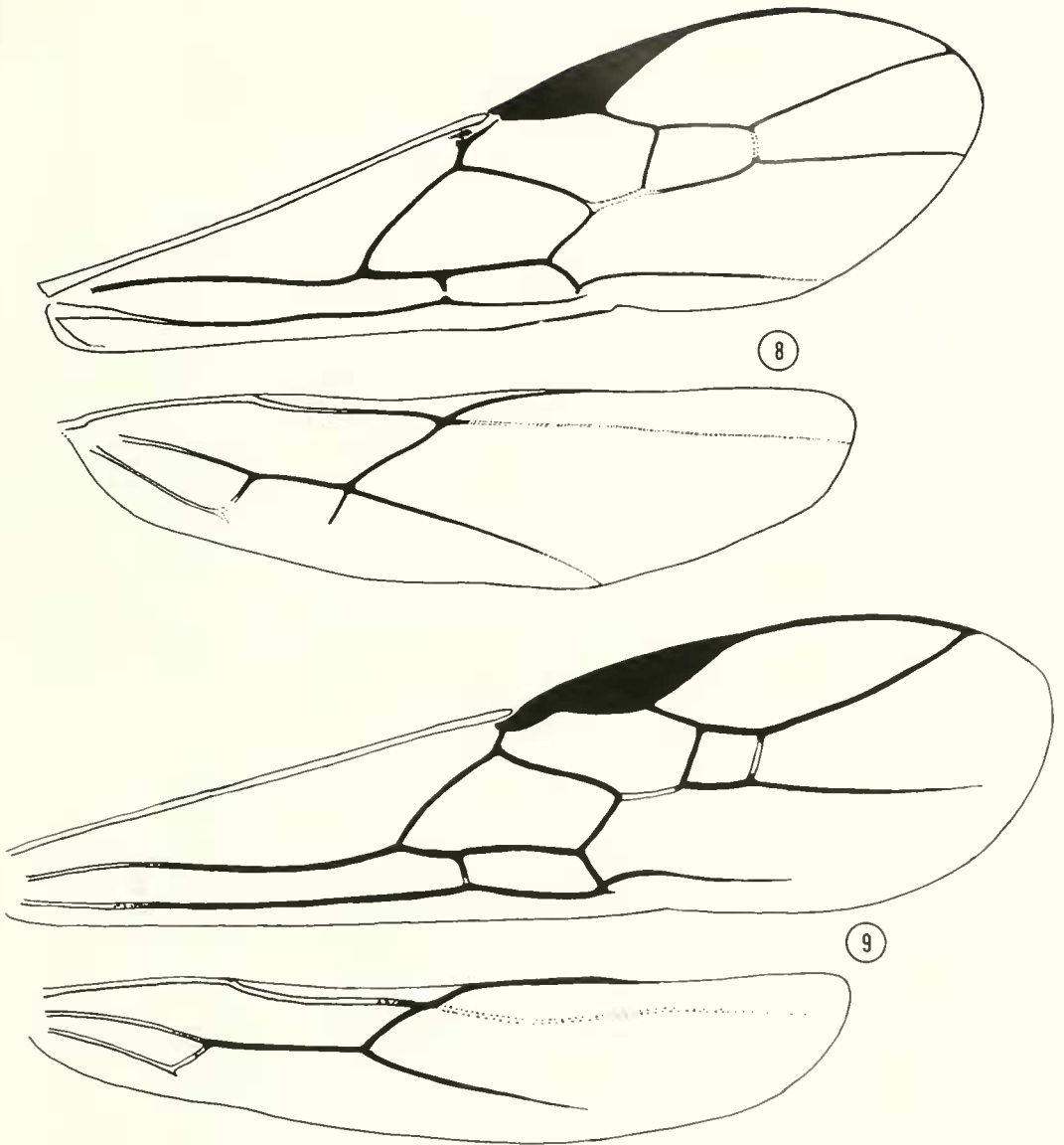
Biology.—Unknown.

Comments.—This species is very distinct from others in this group as well as all North American species in the genus by its distinctive spotted color pattern. We have seen similar color patterns in a few unidentified specimens from Central America and it is possible *pardalotus* is a northern extension of a Neotropical species.

Etymology.—The specific name is from the Greek *pardalotus* meaning “spotted like a leopard” in reference to its spotted color pattern.

Aleiodes preclarus Marsh and Shaw,
new species

Female.—*Color*: antenna black, scape yellow ventrally, pedicel yellow at apex, first flagellomere yellow at base; head yellow, face medially, clypeus, ocellar triangle, occiput and lower part of temple black; propleuron black; pronotum yellow with black spot dorsally; mesonotum black, occasionally yellow medially; mesonotum black, yellow dorsally; propodeum yellow dorsally, black dorsal-laterally, yellow laterally; metasoma orange, first tergum black at basal lateral corners; fore leg yellow, middle leg yellow, middle femur black at apex, hind coxa yellow, black at apex, hind trochanters yellow, hind femur black, yellow at base, hind tibia black, yellow at base, hind tarsus yellow; wings hyaline, infuscated around veins, veins black, fore wing vein C+SC+R yellow in middle, veins M+Cu and 1-1A yellow, stigma black with weak yellow spots at extreme base and apex, hind wing veins C+SC+R, SC+R, M+Cu, 1M, 1A and cu-a yellow, tegula brown. *Size*: body length, 5.5–6.0 mm; fore wing length



Figs. 8, 9. Wings of *Aleiodes* spp. 8, *A. femoratus*. 9, *A. akidnus*.

5.5–6.0 mm. *Head*: eyes and ocelli large, covering most of head; 52–55 antennomeres, all flagellomeres longer than wide; malar space short, slightly shorter than basal width of mandible and about $\frac{1}{5}$ eye height; temple narrow, about $\frac{1}{4}$ eye width; occipital carina briefly interrupted behind ocelli, meeting hypostomal carina; hypoclypeal depression small and circular, diameter equal to malar space; clypeus swollen; ocel-

li moderate in size, ocellocular distance about $\frac{3}{4}$ diameter of lateral ocellus; face coriaceous rugulose, frons procate coriaceous, vertex and temple coriaceous, occiput smooth and shining; maxillary palpus not swollen. *Mesosoma*: pronotum porcate; mesonotum and scutellum strongly coriaceous; notauli weak and finely scrobiculate, meeting in small rugose area before scutellum; mesopleuron coriaceous dorsally,

strongly rugose ventrally along sternaulus and at subalar sulcus; propodeum rugose coriaceous dorsally, coriaceous laterally, median carina complete. *Wings*: fore wing with vein r $\frac{1}{2}$ length of 3RSa, vein 1cu-a beyond 1M by distance equal to twice length of 1cu-a, vein 1CUa only slightly shorter than 1CUB; hind wing with vein RS parallel to wing margin for $\frac{1}{2}$ its length, angled downward beyond, marginal cell widened to apex, vein 1r-m longer than 1M, vein M+CU twice as long as 1m, vein m-cu a distinct tubular vein and about $\frac{3}{4}$ as long as 1M. *Legs*: apex of hind tibia with dense cluster of flattened setae on inner side; tarsal claws not pectinate. *Metasoma*: first tergum costate coriaceous, longer than apical width, median carina complete; second tergum costate coriaceous, median carina complete; third tergum costate coriaceous on basal $\frac{2}{3}$, coriaceous on apical $\frac{1}{3}$, median carina on basal $\frac{2}{3}$; remainder of terga finely coriaceous; ovipositor about $\frac{1}{4}$ length of hind basitarsus.

Male.—Essentially as in female; flagellum yellow, stigma more distinctly bicolored.

Holotype.—♀: WEST VIRGINIA, Pocahontas Co., Monongahela National Forest, June 5, 1995, plot 16-10, Petrice/Roth, ex *Hypoprepia fucosa* on white oak, em. June 19, 1995. Deposited in USNM.

Paratypes.—WEST VIRGINIA: 2 ♀, same data as holotype with dates of May 29, 1995 and July 1, 1996 and host tree of red oak. VIRGINIA: 1 ♂, George Washington National Forest, Dearfield Co., May 22, 1995, Petrice/Roth, ex *Hypoprepia fucosa* on red maple. KENTUCKY: 1 ♀, Crail Hope, July 7, 1948, Carl Cook. Deposited in USNM, RMSEL, WVU.

Distribution.—Known only from the states of West Virginia, Virginia, and Kentucky.

Biology.—Reared from the lichen-feeding arctiid *Hypoprepia fucosa* Hbn. on white oak, red oak, and red maple.

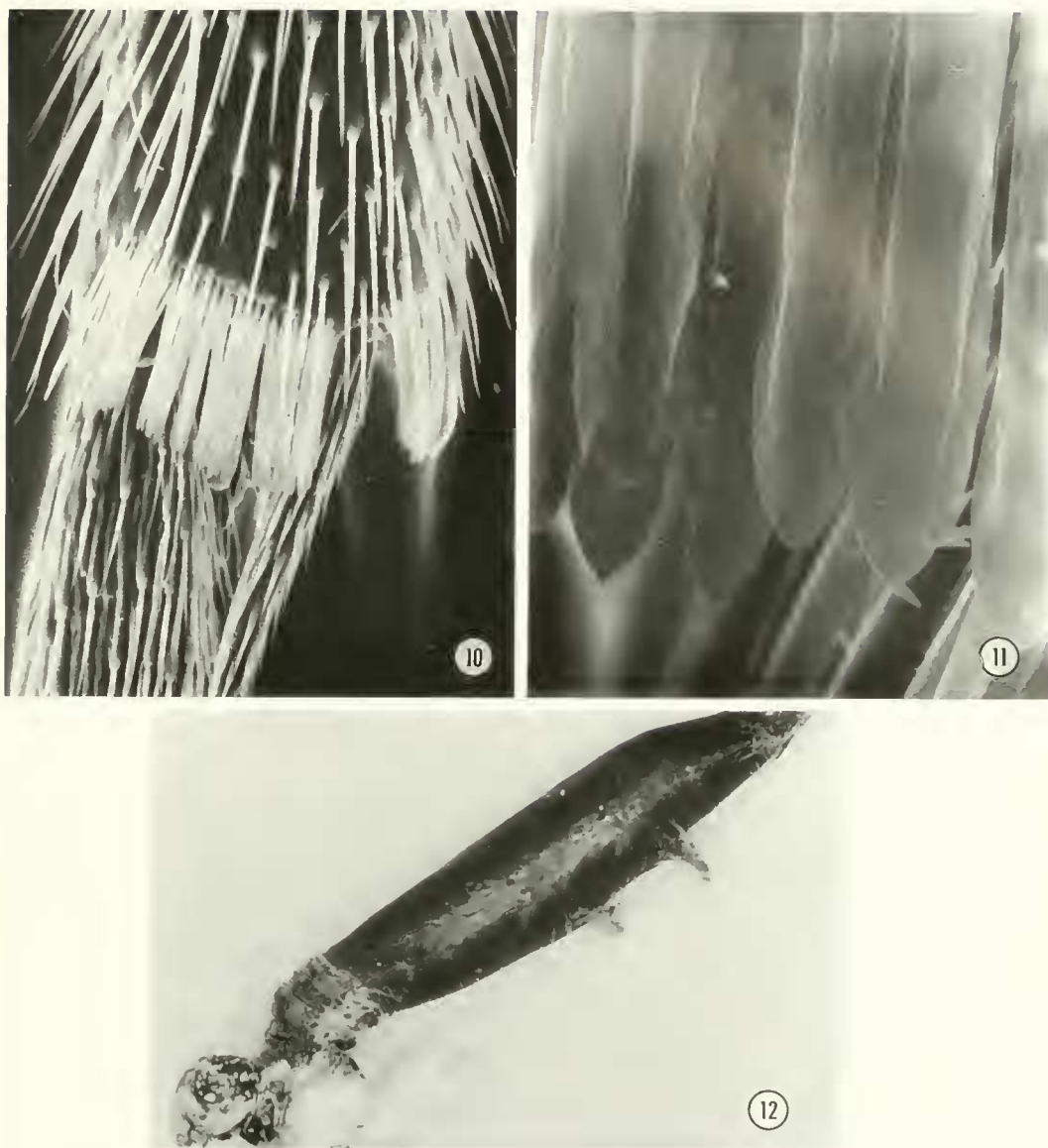
Comments.—This species is similar to *wahli* but can be distinguished by its black

flagellum. The distinction between *preclarus*, *wahli* and *virginiensis* is mostly by color; perhaps after more material is collected it will be shown that this as all one species with a large range of color.

Etymology.—The specific name is from the Latin *preclarus* meaning very beautiful, splendid, in reference to the striking coloration of this species.

Aleiodes virginiensis Marsh and Shaw,
new species
(Figs. 5, 7)

Female.—*Color*: entire body including antennae honey yellow, propodeum dorsally, metasomal terga 1-3 and hind femora somewhat darker; scape and pedicel with brown longitudinal stripe on posterior side, apex of flagellum occasionally darker; ocellar triangle black; wings slightly dusky, stigma bicolored brown with yellow at base and apex, fore wing veins C+Sc+R, M+Cu, 1-1A and 1-R1 yellow, remainder of veins brown, tegula yellow, hind wing veins 1-Sc+R, M+Cu, 1-M, 1-1A and cu-a yellow, remainder of veins brown. *Size*: body length, 7-8 mm; fore wing length, 6-7 mm. *Head*: eyes and ocelli large, covering much of head; 58-63 antennomeres, all flagellomeres longer than wide; malar space short, equal to basal width of mandible and about $\frac{1}{4}$ eye height; temple very narrow, at its narrowest nearly $\frac{1}{5}$ eye width; occipital carina reaching hypostomal carina, interrupted on vertex below ocelli (Fig. 5); hypoclypeal depression small and circular, width equal to basal width of mandible and less than $\frac{1}{2}$ face height; clypeus weakly swollen; ocelli large, ocellular distance $\frac{1}{2}$ diameter of lateral ocellus (Fig. 5); face and frons coriaceous and weakly rugulose, temple and vertex coriaceous; maxillary palpus not swollen; mandibles small, tips not crossing when closed. *Mesosoma*: pronotum porcate laterally; mesonotum and scutellum coriaceous, notauli weakly scrobiculate, meeting in triangular rugose area before scutellum; mesopleuron coriaceous, subalar sulcus rugose, sternaulus represent-



Figs. 10-12. *Aleiodes nigristemmaticum*. 10, 11, Apex of hind tibia showing dense cluster of flat setae. 12, Mummified host.

ed by wide shallow rugose area; propodeum rugose coriaceous dorsally, coriaceous laterally, median carina complete. *Wings* (Fig. 7): fore wing with vein r $\frac{1}{2}$ length of 3RSa and $\frac{1}{5}$ length of m-cu, vein 1cu-a beyond vein 1M by distance about twice length of 1cu-a, veins 1CUa and 1CUB nearly equal in length; hind wing with vein RS parallel to wing margin on basal $\frac{1}{3}$ and suddenly

curved downward, marginal cell broad at apex, vein r-m longer than 1M, vein M+CU about twice length of 1M, vein m-cu strong and at least $\frac{1}{2}$ length of 1M. *Legs*: tarsal claws not pectinate, with few spines at extreme base; hind tibia with row of dense coalesced flattened setae at apex on inner side, inner spur less than $\frac{1}{2}$ length of hind basitarsus; hind coxa coriaceous dorsally.

Metasoma: first tergum costate coriaceous, longer than apical width, median carina complete; second tergum costate coriaceous, median carina complete; third tergum costate coriaceous on basal $\frac{3}{4}$, coriaceous on apical $\frac{1}{4}$, median carina complete on basal $\frac{3}{4}$; remainder of terga coriaceous; ovipositor about $\frac{1}{2}$ length of hind basitarsus.

Male.—Unknown.

Holotype.—♀: VIRGINIA, Essex Co., 1 mi SE Dunnsville, August 27–September 16, 1991, Malaise trap, D. R. Smith. Deposited in USNM.

Paratypes.—VIRGINIA, 2 ♀s, same data as holotype except dates of July 12–26, 1991 and July 27–August 16, 1991. Deposited in USNM, RMSEL.

Distribution.—Known only from the type locality in Virginia.

Biology.—Unknown.

Comments.—This species is similar to *preclarus* and *wahli* but is distinguished by its entirely yellow color (see comments under *preclarus*).

Etymology.—The specific name refers to the type locality of this species.

Aleiodes wahli Marsh and Shaw,
new species

Female.—*Color*: head yellow, ocellar triangle, face medially and occiput brown; antenna yellow, scape and pedicel with brown longitudinal stripe posteriorly, basal flagellomeres occasionally brown at base; mesosoma yellow with brown markings on propleuron, pronotum dorsally, along notaulices and margins of mesonotum and scutellum, along subalar groove and sternaulus of mesopleuron, and on propodeum laterally and apically, propodeum light brown dorsally; metasomal terga light brown, sterna yellow, first metasomal tergum with black spots at basal corners, ovipositor sheaths yellow, black on apical half; legs yellow, hind coxa brown at apex, hind femur brown on apical $\frac{3}{4}$; wings dusky along most veins, tegula brown, fore wing veins C+Sc+R, 1R1, M+Cu and I-1A

yellow, remainder brown, stigma brown with small yellow spots at apex and usually at base, hind wing veins C+SC+R, SC+R, M+Cu, I-1A and cu-a yellow, remainder brown. *Size*: body length, 5.5–6.0 mm; fore wing length, 5.5–6.0 mm. *Head*: eyes and ocelli large, covering much of head; 56–59 antennomeres, all flagellomeres longer than wide; malar space short, equal to basal width of mandible and about $\frac{1}{4}$ eye height; temple very narrow, at its narrowest nearly $\frac{1}{5}$ eye width; occipital carina reaching hypostomal carina, slightly interrupted on vertex behind ocelli; hypoclypeal depression small and circular, width equal to basal width of mandible and less than $\frac{1}{2}$ face height; clypeus weakly swollen; ocelli large, ocellocular distance $\frac{1}{2}$ diameter of lateral ocellus; face and frons rugose coriaceous, temple and vertex coriaceous; maxillary palpus not swollen; mandibles small, tips not crossing when closed. *Mesosoma*: pronotum porcate laterally; mesonotum and scutellum coriaceous, notauli weakly scrobiculate; mesopleuron coriaceous, subalar sulcus rugose, sternaulus represented by wide rugose area; propodeum rugose coriaceous dorsally, coriaceous laterally, median carina complete. *Wings*: fore wing with vein r $\frac{1}{2}$ length of 3RSa and $\frac{1}{5}$ length of m-cu, vein 1cu-a beyond 1M by distance slightly more than twice length of 1cu-a, vein 1CUa noticeably shorter than 1CUB; hind wing with vein RS parallel to wing margin on basal $\frac{1}{3}$ and curved downward, marginal cell broad at apex, vein r-m longer than 1M, vein M+CU about twice length of 1M, vein m-cu strong and about $\frac{1}{2}$ length of 1M. *Legs*: tarsal claws not pectinate, with few spines at extreme base; hind tibia with row of dense coalesced flattened setae at apex on inner side, inner spur less than $\frac{1}{2}$ length of basitarsus; hind coxa coriaceous dorsally. *Metasoma*: first tergum costate coriaceous, longer than apical width, median carina complete; second tergum costate coriaceous, median carina complete; third tergum costate coriaceous on basal $\frac{3}{4}$, coriaceous on apical $\frac{1}{4}$, median carina complete

on basal $\frac{3}{4}$; remainder of terga coriaceous; ovipositor about $\frac{1}{2}$ length of hind basitarsus.

Male.—Essentially as in female.

Holotype.—♀: FLORIDA, Highlands Co., Archbold Biol. Sta., November 27, 1987, D. Wahl. Deposited in AEI.

Paratypes.—FLORIDA: 10 ♀, 2 ♂, same data as holotype except, dates of December 6, 1984, November 29, 1985, October 9, 1987, November 27, 1987, December 4 and 18, 1987, January 2–11, 1988, and collector M. Deyrup; 1 ♀, Liberty Co., Torreya St. Pk., August 30, 1978; 1 ♀, Dade County, Fuch's Hammock, near Homestead, May 25, 1979, Terhune S. Dickel and H. V. Weems, Jr.; 1 ♂, Levy Co., September 9, 1955, H. V. Weems, Jr. NORTH CAROLINA: 1 ♀, Martin Co., near Williamston, October 6, 1978, Malaise trap. Deposited in AEI, FSCA, USNM, RMSEL, NCDA, ABS.

Distribution.—Known only from the type localities in Florida and North Carolina.

Biology.—Unknown.

Comments.—This species is nearly similar to *virginiensis* and *preclarus* but is distinguished by its yellow flagellum (see comments under *preclarus*).

Etymology.—This species is named for our colleague and friend, David Wahl, American Entomological Institute, Gainesville, Florida, who collected many specimens of the type series from Florida.

ACKNOWLEDGMENTS

We thank Les Price, formerly of the University of Wyoming (presently at the University of Arkansas) for the information on the biology of *nigristemmaticum*, and Linda Butler, West Virginia University, for information on the biology of *preclarus*. We are also thankful to Donald Azuma, for the loan of the holotype of *femoratus*, to E. Kierych, Polish Academy of Sciences, Warsaw, for the loan of the holotype of *nigristemmaticum*, and to the curators of all the collections listed in Methods for the loan of spec-

imens for this study. This research was supported, in part, by grant DEB-930-6314 from the National Science Foundation to S. R. Shaw. Additional support was provided by supplemental REU grants in 1994, 1995 and 1996 (Research Experience for Undergraduates), some of which provided funding for the work in Costa Rica by Les Price.

LITERATURE CITED

- Achterberg, C. van. 1979. A revision of the subfamily Zelinae auct. (Hymenoptera: Braconidae). *Tidschrift voor Entomologie* 122: 241–479.
- Achterberg, C. van. 1991. Revision of the genera of the Afrotropical and W Palearctical Rogadinae Foerster (Hymenoptera: Braconidae). *Zoologische Verhandlungen* 273: 1–120.
- Cresson, E. T. 1869. List of the North American species of the genus *Aleiodes* Wesmael. *Transactions of the American Entomological Society* 2: 377–382.
- Enderlein, G. (1918)1920. Zur Kenntnis aussureuropäischer Braconiden. *Archiv für Naturgeschichte* 84A(11): 51–224.
- Fortier, J. C. 1997. Cladistics of the *Aleiodes* lineage of the subfamily Rogadinae (Hymenoptera: Braconidae). Doctoral Dissertation, University of Wyoming, Laramie, 132 pp.
- Goulet, H. and J. T. Huber. 1993. *Hymenoptera of the World: An Identification Guide to Families*. Agriculture Canada Publication 1894/E, Ottawa, 668 pp.
- Harris, R. A. 1979. A glossary of surface sculpturing. *Occasional Papers in Entomology of the California Department of Food and Agriculture* no. 28, pp. 1–31.
- Marsh, P. M. 1989. Notes on Braconidae (Hymenoptera) associated with jojoba (*Simmondsia chinensis*) and descriptions of new species. *Pan-Pacific Entomologist* 65: 58–67.
- Shaw, M. R. 1983. On[e] evolution of endoparasitism: the biology of some genera of Rogadinae (Braconidae). *Contributions of the American Entomological Institute* 20: 307–328.
- Shaw, M. R. 1994. Chapter 7, Parasitoid Host Ranges, pp. 112–144. *In* Hawkins, B. A. and W. Sheehan, eds., *Parasitoid Community Ecology*. Oxford University Press, Oxford.
- Shaw, M. R. and T. Huddleston. 1991. Classification and biology of braconid wasps. *Handbooks for the Identification of British Insects* 7: 1–126.
- Shaw, S. R. 1993. Systematic status of *Eucystomastax* Brues and characterization of the Neotropical species. *Journal of Hymenoptera Research* 2: 1–11.
- Shaw, S. R. 1995. Chapter 12.2, Braconidae, pp. 431–463. *In* Hanson, P. E. and I. D. Gauld, eds., *The*

- Hymenoptera of Costa Rica. Oxford University Press, Oxford.
- Shaw, S. R. 1997. Subfamily Rogadinae s.s., pp. 402–412. In Wharton, R. A., P. M. Marsh and M. J. Sharkey, eds., Manual of the New World genera of the family Braconidae (Hymenoptera). Special Publication of the International Society of Hymenopterists, Number 1, 439 pp.
- Shaw, S. R., P. M. Marsh, and J. C. Fortier. 1997. Revision of North American *Aleiodes* Wesmael (Part 1): The *pulchripes* Wesmael species-group in the New World (Hymenoptera: Braconidae, Rogadinae). Journal of Hymenoptera Research 6(1):10–35.
- Shaw, S. R., P. M. Marsh, and J. C. Fortier. 1998. Revision of North American *Aleiodes* Wesmael (Part 2): The *ductor* Thunberg species-group in the New World (Hymenoptera: Braconidae, Rogadinae). Journal of Hymenoptera Research 7:62–73.
- Wharton, R. A., P. M. Marsh, and M. J. Sharkey, eds. 1997. Manual of New World genera of the family Braconidae. Special Publication of the International Society of Hymenopterists, Number 1, 439 pp.